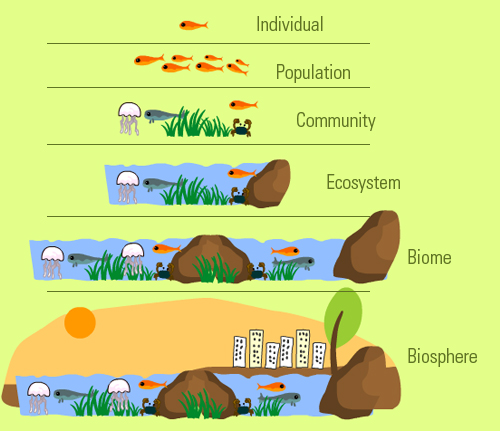
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**Unit 9, Part 1 Notes: Ecology Basics, Succession, and Community Relationships**

Pre-AP Biology, Mrs. Krouse

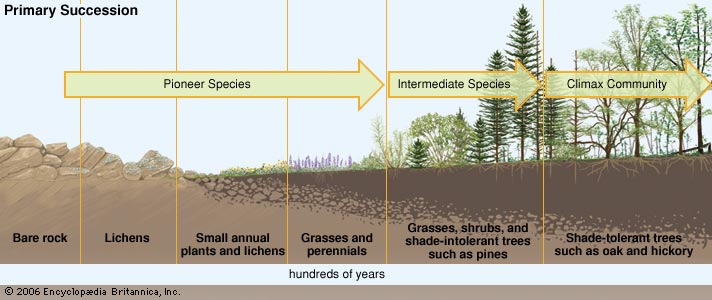
**Ecology Basics**

1. **Ecology** is the study of the interactions between organisms and the living and nonliving components of their environment.
2. There are several different levels of organization that scientists have defined within the field of ecology. These levels are identified below from largest to smallest.
3. The **biosphere** consists of the parts of the earth and its atmosphere that can support living creatures. It extends 11 kilometers below the surface of the ocean up to eight kilometers above the surface of the earth. There are even bacteria that live up in the cloud layer!
4. A **biome** consists of a group of ecosystems (see definition below) that have similar dominant species and the same climate. A dominant species is a species with a high abundance within an ecosystem. An example of a terrestrial (land) biome is the tropical rainforest. An example of an aquatic (water) biome is a coral reef.
5. An **ecosystem** consists of all the organisms living in a particular area along with the non-living components of the environment in that area.
6. A **community** consists of all the organisms living in a particular area.
7. A **population** consists of all the members of the same species living in a particular area.
8. An **organism** is a single living thing.
9. There are two types of factors that can affect organisms within an ecosystem—biotic factors and abiotic factors.
10. **Biotic factors** are living things that can affect organisms within an ecosystem. For example, predators are biotic factors that influence their prey species. Additionally, infectious diseases that are caused by bacteria are considered biotic factors because bacteria are living things.
11. **Abiotic factors** are non-living things that can affect organisms within an ecosystem. For example, precipitation rates affect water availability for plants, animals, etc. Another example abiotic factor is air temperature.
12. We define an organism’s **habitat** as the area in which it lives. In other words, an organism’s habitat is its “address.”
13. We define an organism’s **niche** as its role in its environment. In other words, an organism’s niche is its “job.” An organism’s niche includes the following components (and others!)…
14. The resources it uses. This includes what the organism eats and how it obtains its food.
15. The other species the organism interacts with and the nature of these relationships. (Do they have a predator/prey relationship? Do they have a mutualistic relationship where both species benefit from the interaction?)
16. The conditions it tolerates (ex: a certain temperature range) and how it tolerates these conditions.
17. When and how it reproduces.

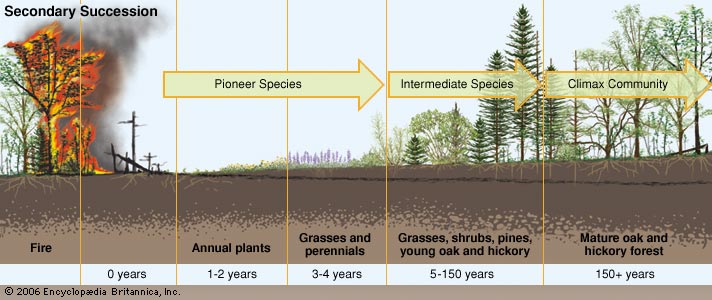
1. There are two “levels” of niche that biologists study. These levels are described below.
2. An organism’s **fundamental niche** is the range of resources the organism COULD use and the range of conditions it COULD tolerate.
3. An organism’s **realized niche** is the range of resources the organism actually DOES use and the range of conditions it actually DOES tolerate in the area in which it lives.
4. For example, eating earthworms is technically part of our fundamental niche because we could eat them, digest them, and use them for energy. Eating earthworms is not, however, part of our realized niche because we (hopefully) do not actually choose to eat earthworms.
5. The realized niche is part of the fundamental niche.
6. There are two types of organisms based on the relative “sizes” of their niches. These types of organisms are described below.
7. **Generalists** are organisms with broad/large niches. For example, raccoons would be considered generalists because they will eat just about anything!
8. **Specialists** are organisms with narrow/small niches. For example, koalas would be considered specialists because they only eat eucalyptus leaves. Similarly, giant pandas would be considered specialists because they eat only bamboo.

**Ecological Succession**

1. **Ecological succession** is defined as a series of changes in the composition of species living in a community over time. These changes are often predictable because they tend to follow the same basic progression.
2. In terrestrial (land) ecosystems, **primary succession** begins when there is no existing soil layer. This can occur when volcanic eruptions create new islands or bury existing land in lava that hardens to volcanic rock. Once this occurs, the following events typically take place.
3. **Lichens** begin to cover the bare volcanic rock. Lichens are a symbiotic relationship between an algae and a fungus, and they are able to live on bare rock (see image to the right). Lichens are considered **pioneer species** because they are the first species to colonize the area. Pioneer species are typ ically small, have high rates of reproduction, and have short life spans.
4. When alive, lichens help to break apart the rock. When they die, their decaying bodies form a soil layer, which will allow other plants to grow.
5. Mosses typically colonize the area next because they can live in a thin soil layer. When they die, their decaying bodies add to the soil layer. At this time, grasses may also start to take root.
6. Eventually, shrubs and trees begin to grow in the deepening soil layer. The first trees to colonize the area are typically coniferous trees that do not lose their leaves in the fall (ex: pine trees).
7. At some point, the community reaches a point of stability and little change is seen in the composition of species within the community unless there is a major change in the environment. This community is called a **climax community**. In some deciduous forests (i.e., forests that include trees that lose their leaves in the fall), the climax community is a mature oak-hickory forest. This type of forest has an abundance of hardwood trees, including oak and hickory trees.

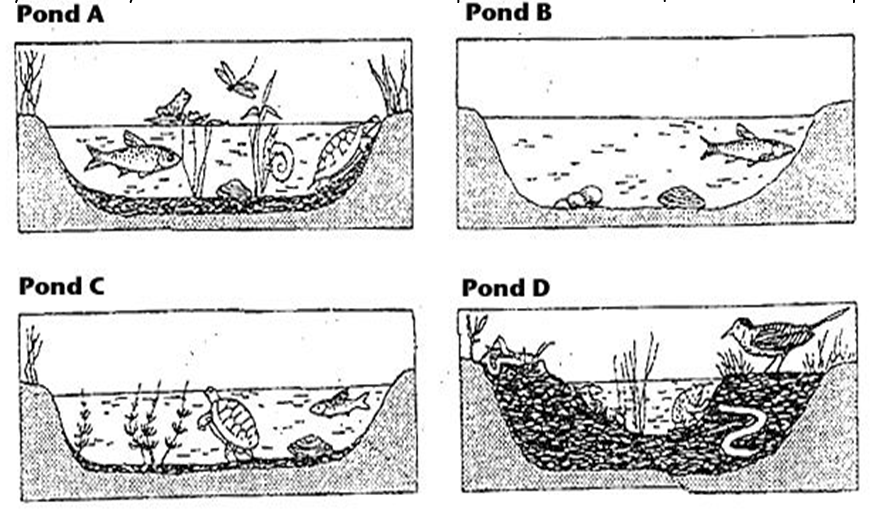


1. **Secondary succession** begins when there is a major disturbance in the ecosystem that kills off many organisms within the community but does not completely remove the soil layer. An example of such a disturbance is a forest fire. Secondary succession does not need to begin with species like lichens because there is already a soil layer in which small plants (ex: mosses and grasses) can take root.



***Practice Question #1:*** Answer each of the questions given below regarding ecological succession in an aquatic ecosystem.

Succession in aquatic ecosystems can last for thousands of years. The process cannot be observed directly. Instead, scientists observe different bodies of water at various stages of succession and arrange these stages to create a logical timeline of events. Below are illustrations and descriptions of four ponds in various stages of succession. Succession in these ponds begins when they are cut off from a larger body (ex: a lake) that they were once a part of. Use the illustrations and descriptions to answer the questions about the ponds.



**Pond A:** Cattails, bulrushes, and water lilies grow in the pond. These plants have their roots in the bottom of the pond, but they can reach above the surface of the water. This pond is an ideal habitat for the animals that must climb to the surface for oxygen. Aquatic insect larvae are abundant. They serve as food for larger insects, which in turn are food for crayfish, frogs, salamanders, and turtles.

**Pond B:** Plankton growth is rich enough to support animals that entered when the pond was connected to the lake. Fish make nests on the sandy bottom. Mussels crawl over the bottom.

**Pond C:** Decayed bodies of plants and animals form a layer of humus over the bottom of the pond. Chara, branching green algae, covers the humus. Fish that build nests on the bare bottom have been replaced by those that lay their eggs on the Chara.

**Pond D:** The pond is so filled with vegetation that there are no longer any large areas of open water. Instead, the pond is filled with grasses. The water dries up during the summer months.

a. Place these images in order to represent the stages of succession in a pond ecosystem. Explain your answer.

b. Some amphibians and crayfish can withstand periods of dryness by burying themselves in mud. In which pond would they survive best and why?

c. Some mussels require a sandy bottom in order to maintain an upright position. In which pond will they die out and why?

d. Which pond would most the most likely to lead to terrestrial succession and why?

e. The area around the pond is an oak-hickory forest. After the pond fills in, the area will undergo another series of stages of succession and eventually develop into a stable community called an oak-hickory forest. What is the term ecologists use to describe the oak-hickory forest, which will not have a major change in its species composition unless there is a large environmental disturbance?

***Practice Question #2:*** Answer each of the questions given below regarding ecological succession in a terrestrial ecosystem.

a. In a certain area of North Texas some ground was cleared. Soon afterwards, grasses began to grow in the area. After 10 years, small bushes replaced the grasses. Is this an example of primary or secondary succession and why?

b. Which organisms would most likely be the pioneer organisms on a newly formed volcanic island?

A) Coniferous trees

B) Lichens

C) Deciduous trees

D) Tall grasses

c. Starting on bare rock, what is the usual ecological succession of organisms?

A) mosses 🡪 grasses 🡪 shrubs 🡪 trees

B) lichens 🡪 grasses 🡪 shrubs 🡪 trees

C) lichens 🡪 shrubs 🡪 grasses 🡪 trees

D) shrubs 🡪 grasses 🡪 lichens 🡪 trees

**Community Relationships**

1. Within a community, different species interact with one another. A **symbiosis** is defined as any close relationship between members of different species. Several types of symbioses (plural of symbiosis) are described below.
2. **Predation** occurs when one organism hunts and kills another organism for food. The first organism is the **predator** and the second organism is the **prey**. We can represent this relationship with the symbols +/-, which indicates that the predator benefits (+), and the prey is harmed (-). An example of a predator/prey relationship is a lion hunting a gazelle.



1. **Parasitism** occurs when one organism benefits and the other organism is harmed but does not die (as is the case with predation). The organism that benefits is called the **parasite**. The organism that is harmed is called the **host**. We can represent this relationship with the symbols +/-, which indicates that the parasite is positively affected (+) by the relationship, and the host is negatively affected (-) by the relationship. The parasite does not typically kill the host because it would then need to find a new host. If it does kill the host, it does so very slowly.

-If the parasite lives on the surface of the host’s body, it is called an **ectoparasite**. An example of an ectoparasite is a tick that can attach to our skin and use our blood as a source of nutrition. 

-If the parasite lives inside the host’s body, it is called an **endoparasite**. An example of an endoparasite is a tapeworm, which can enter our digestive system when we eat contaminated foods. The tapeworm then lives in our intestines and uses our partially-digested food as a source of nutrition.

1. **Competition** occurs when two species use the same resources. They are both negatively affected by the relationship because neither species can acquire as many nutrients as it could without the other species present. We can represent this relationship with the symbols -/-. An example of a competitive relationship is a lizard and frog that both eat the same type of insect.



1. **Mutualism** occurs when two species benefit from their relationship with one another. We can represent this relationship with the symbols +/+. An example of a mutualistic relationship is a bee and a flowering plant. The bee helps the plant by spreading its pollen to assist with reproduction. The plant helps the bee by providing a sugary substance called nectar for the bee to eat.
2. **Commensalism** occurs when one species benefits from the relationship and the other species is neither helped nor harmed. In other words, the second species is “neutral.” We can represent this relationship with the symbols +/0, where “0” represents neutral. An example of a commensalistic relationship is a pilot fish and a shark. The pilot fish is a small fish that follows below a shark and eats small scraps of the shark’s food that the shark has discarded. The pilot fish benefits because it gets food, and the shark is unaffected because it would not eat the scraps anyway.

***Practice Question #3:*** For each description of a symbiotic relationship given below, identify the specific type of symbiosis (i.e., predation, parasitism, competition, mutualism, or commensalism). Then, explain your choice.

1. Snapping shrimp have poor vision and depend on their goby fish roommate to give the danger signal when predators come and guide them back home if they wander too far. Goby fish who don’t have a place to hide are quickly eaten. They find a snapping shrimp roommate who digs a hole for both to live in.

**Type of symbiosis:**

**Explanation:**

1. Remora use suckers to attach temporarily to large marine animals such as sharks, manta rays, whales, turtles, or large fish. The shark provides free transportation, protection, and dropped food and feces which the remora feeds on. The host is not injured.

**Type of symbiosis:**

**Explanation:**

1. A wasp will sting and paralyze a spider. It will take the spider to a nest and lay an egg on it. The larvae will eat the still-living spider from the inside out.

**Type of symbiosis:**

**Explanation:**